

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

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File

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NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing  
(day/month/year)

22.07.2004

Applicant's or agent's file reference  
15.76772

## IMPORTANT NOTIFICATION

International application No.  
PCT/EP 02/04044

International filing date (day/month/year)  
11.04.2002

Priority date (day/month/year)  
11.04.2002

Applicant  
BOREALIS TECHNOLOGY OY et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international  
preliminary examining authority:



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# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT (PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>15.76772</b>	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. <b>PCT/EP 02/04044</b>	International filing date ( <i>day/month/year</i> ) <b>11.04.2002</b>	Priority date ( <i>day/month/year</i> ) <b>11.04.2002</b>
International Patent Classification (IPC) or both national classification and IPC <b>G01N21/72</b>		
Applicant <b>BOREALIS TECHNOLOGY OY et al.</b>		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 8 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 8 sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I <input checked="" type="checkbox"/> Basis of the opinion</li> <li>II <input type="checkbox"/> Priority</li> <li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV <input checked="" type="checkbox"/> Lack of unity of invention</li> <li>V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI <input type="checkbox"/> Certain documents cited</li> <li>VII <input type="checkbox"/> Certain defects in the international application</li> <li>VIII <input type="checkbox"/> Certain observations on the international application</li> </ul>		
Date of submission of the demand  <b>07.11.2003</b>	Date of completion of this report  <b>22.07.2004</b>	
Name and mailing address of the international preliminary examining authority:  <div style="display: flex; align-items: center;"> <div>             European Patent Office - P.B. 5818 Patentlaan 2              NL-2280 HV Rijswijk - Pays Bas              Tel. +31 70 340 - 2040 Tx: 31 651 epo nl              Fax: +31 70 340 - 3016           </div> </div>	Authorized Officer  <b>Scheu, M</b>  Telephone No. +31 70 340-3492	



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. **PCT/EP 02/04044**

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, Pages**

1, 7, 8 as originally filed  
2-6 filed with telefax on 07.07.2004

**Claims, Numbers**

1-24 filed with telefax on 07.07.2004

**Drawings, Sheets**

1/2-2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**IV. Lack of unity of invention**

1. In response to the invitation to restrict or pay additional fees, the applicant has:

- ☐ restricted the claims.  
☐ paid additional fees.  
☐ paid additional fees under protest.  
☐ neither restricted nor paid additional fees.

2. ☒ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.  
☒ not complied with for the following reasons:

**see separate sheet**

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☒ all parts.  
☐ the parts relating to claims Nos. .

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	1-23
	No: Claims	24
Inventive step (IS)	Yes: Claims	
	No: Claims	1-24
Industrial applicability (IA)	Yes: Claims	1-24
	No: Claims	

2. Citations and explanations

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**see separate sheet**

**Re Item IV**

**Lack of unity of invention**

This Authority found that the application contains two groups of invention, namely

- claims 1-23: Method and apparatus for viewing the flame produced by a burner in a furnace, wherein the fuel burnt by the burner is natural gas, comprising viewing the flame through an interference filter adapted to pass light of the wavelength of sodium only.
- claim 24: Glasses comprising an interference filter in each lens thereof adapted to pass light of the wavelength of sodium only.

Interference filters adapted to pass light of the wavelength of sodium only are generally known in the art and commercially available. Hence the common feature of both group of inventions is not new.

The first group of inventions relates to a method an apparatus for viewing the flame by a burner in a furnace, wherein the fuel burnt is natural gas. The problem solved by the method an apparatus is to view the flame in a furnace even if a significant background light is available.

The second group of inventions relates to goggles transparent to a certain wavelength range. The technical problem solved by goggles with interference filters is the improved working comfort for the use and the possibility to have the filter in front of the eyes of the wearer independently of the head movements.

Thus the two inventions do have no special feature in common and do not provide solutions to a linear linked series of problems.

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

Reference is made to the following documents:

- D1: US-A-4 820 046 (SOHMA KENICHI ET AL) 11 April 1989 (1989-04-11)  
D2: US-A-4 466 943 (MURASE ISAO ET AL) 21 August 1984 (1984-08-21)  
D3: GB-A-1 128 625 (ATOMIC ENERGY AUTHORITY UK) 25 September 1968 (1968-09-25)  
D4: WO 99/50649 A (RICHARDSON GRANT STUART ;ROBINS GEORGE (GB); SECR DEFENCE (GB); JO) 7 October 1999 (1999-10-07)  
D5: GB-A-1 605 192 (COMMISSARIAT ENERGIE ATOMIQUE) 7 April 1983 (1983-

04-07)

1. The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of independent claims 1, 13 and 23 is not inventive in the sense of Article 33(2) PCT.

1.1. D1, which is considered as the closest prior art for independent claim 1, discloses a method of viewing the flame produced by a burner in a furnace, comprising viewing the flame through an interference filter adapted to pass light of a desired wavelength. (see column 1, line 30-column 2, line 37).

The subject-matter of claim 1 therefore differs from this known method in that the flame fuel burnt is natural gas and that the filter transmits the sodium line.

The technical effect of this features is that the signal from the flame is to transmit a strong signal from the flame and to minimize light from the background. Hence the problem solved by the present invention is to improve the visibility of burner flames against a strong background of radiant heat given off from the walls.

The solution proposed in claim 1 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT) for the following reasons: The person skilled in the art and interested in viewing the flame of natural gas would determine the wavelength in which the background of the radiant heat given off from the walls is minimum and where the burner flame for natural gas peaks by a simple spectroscopic analysis. From such a spectroscopic analysis the skilled person would find that the burner flame for natural gas peaks at the sodium line. Hence the skilled person, having knowledge of D1, would choose a interference filter of the sodium line as the desired wavelength and without any inventive step arrive at a method according to claim 1.

Hence claim 1 lacks inventive step.

1.2. Apparatus claim 13 lacks inventive step for the same reasons, mutatis mutandis.

1.3 Method claim 1 and apparatus claim 13 lack also inventive step with respect to D2 (cf. figure 1, column 1, lines 11-20; column 3, lines 64 - column 4, line 14) for corresponding arguments as presented in the previous paragraphs, mutatis mutandis.

1.4 Document D4, considered as the closest prior art for claim 23, discloses a furnace (2) comprising a burner suitable for burning natural gas (when natural gas is attached to inlets 3 or 4) within the walls thereof, and a window (17) provided in a wall of the

furnace (see page 6, line 9), wherein an interference filter adapted to pass light of the wavelength of sodium only is provided in proximity to the window (see page 6, paragraph 3).

Applying the interference filter *in or on the window* is a slight constructional change in which comes within the scope of the customary practice followed by persons skilled in the art, especially as the advantages thus achieved (e.g. less bulky apparatus) can readily be foreseen.

1.5 Claim 23 also lacks inventive step with regard to D3 (see figure and lines 45-61) for the same reasons as given in the previous paragraph, *mutatis mutandis*.

2. The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 24 is not new in the sense of Article 33(2) PCT with respect to document D5 and not inventive in the sense of Article 33(3) PCT over common knowledge.

2.1 D5 discloses glasses comprising an interference filter provided in each lens thereof, wherein the interference filter is adapted to pass light of

a) the combined wavelength of 508,5 nm **AND** 589,5 nm **AND** 628 nm as well as

b) one of the above wavelengths, i.e. 508.5 nm **OR** 589,5 nm **OR** 628 nm.

(see claim 2; see claim 4: "the spectral transmission **window or windows...**")

Hence D5 discloses glasses with an interference filter transmissive for the sodium line (589,5 nm) only. Consequently, claim 24 lacks novelty in view of D5.

2.2 Glasses or goggles with interference filters as well as interference filters transmitting the sodium line only are both are common knowledge and both commercially available. The skilled person would not require any inventive skill to build glasses with 589,5 nm transmissive interference filters in each lens thereof.

Consequently claim 24 lacks inventive step over common knowledge.

2. Dependent claims 2-12 and 14-22 do not contain any features which, in combination



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with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step as the features are either disclosed in the cited documents D1-D4 or refer to mere design options which fall within customary practise of the skilled person

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can be done by adjusting the quantity of fuel supplied to the burner and/or by adjusting the ratio of fuel supplied to air and/or by adjusting the direction of the jets of fuel.

5 In order to monitor the size and orientation of the burner flames, an operator views the flames at regular intervals and then makes any adjustments which may be required. However, the heat in the pyrolysis section is such that the walls of the cracker are heated to a  
10 temperature of about 1100°C. Consequently, radiant heat is given off from the walls to create a bright background against which it is very difficult to see the burner flames.

In the past, this problem has been overcome by  
15 adding either copper or sodium bicarbonate to the flames to provide a colour which is visible against the bright background of the walls of the cracker. To do this however, the pyrolysis chamber must be opened up and the copper or sodium bicarbonate thrown into the flames. It  
20 will be appreciated that at the operating temperatures in question this is a complex procedure which results in significant inconvenience and energy losses.

The present invention seeks to provide a method of viewing the flames of the burners in a furnace such as  
25 the pyrolysis chamber of a cracker which can be carried out quickly and easily and without the need to lose heat from the furnace.

The applicants have realised that if the light emitted by the burner flames or a part of that light  
30 could be separated from the background radiant light in the furnace, the burner flames could then be viewed without the need for complex solutions such as throwing additives into the flames.

From a first aspect, the present invention provides  
35 a method of viewing the flame produced by a burner in a furnace, wherein the fuel burnt by the burner is natural gas, comprising viewing the flame through an

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interference filter adapted to pass light of the wavelength of sodium only.

Thus, the interference filter acts to block out the bulk of the ambient light of the furnace such that the burner flame is clearly visible.

In one preferred embodiment of the invention, the furnace is the pyrolysis section of a petroleum cracker. The method is particularly advantageous in such an environment as the walls of the cracker are heated to a very high temperature such that they emit significant levels of white light which makes it difficult or even impossible to see the flame of a burner in the cracker under normal circumstances.

Typically, the fuel which is burnt in the petroleum cracker is natural gas and most typically, a mixture of hydrogen, methane and air. Tests have shown that this fuel can contain traces of sodium. The reason for this is not known but it is thought to be because methane and natural gas often come from environments in which salt is present. In the method of the invention therefore, the filter used is a sodium interference filter which filters out substantially all the light other than the sodium light emitted by the sodium trace elements in the fuel.

Preferably the sodium interference filter has a pass bandwidth of approximately 10nm so that light of wavelength 0.584 to 0.594 $\mu$ m may pass through the filter. More preferably the pass bandwidth is 2 to 5nm and, still more preferably, the pass bandwidth is 1nm so that only light of wavelength 0.589 $\mu$ m passes through the filter.

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5 The use of a sodium interference filter is particularly advantageous as there is effectively no light of the wavelength of sodium present as ambient light in the furnace such that the burner flame is very clearly visible using this method.

10 The sodium interference filter could take any form and the burner in the furnace could be viewed through a door which is opened in use as in known systems. Preferably however, a window is provided in the wall of the furnace through which the burner can be viewed. This has the advantage that the furnace does not need to be opened each time that the burners are viewed. Thus the temperature inside the furnace is not disturbed and thermal currents which can distort the action of the burner flame are not created by opening and closing the furnace at regular intervals.

15 Preferably, the window is made of quartz which is a material capable of withstanding the temperature gradient across the wall of the furnace while also providing the necessary transparency.

20 In one preferred embodiment, the interference filter could be provided as a panel attached to the window of the furnace.

25 Still more preferably, the filter is a panel which can be placed over the window or removed by a user as required. Thus for example, the filter could be hinged to the wall of the furnace to allow quick and easy adjustment thereof.

In an alternative embodiment, a pair of glasses or

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goggles comprising an interference filter in each lens thereof is provided. This has the advantage of allowing a user to carry the glasses with him for example from one furnace to the next. The goggles have the  
5 additional advantage that they could also be used with a traditional furnace in which no sealed window is provided but a door is merely opened when a user wishes to look inside the furnace.

10 In a still further preferred embodiment of the invention, the interference filter could be provided in a camera arranged inside the furnace and adapted to photograph the burner at regular intervals. The information from the camera could then be relayed to an operator who could make any necessary adjustments to the  
15 burner from a remote location. This would clearly be advantageous in a large scale refinery or similar scale production plant where considerable numbers of personnel would be required to monitor the operation of each furnace in situ.

20 Ideally the camera could be programmed to photograph the burner about once every 10 minutes.

It will be appreciated that the furnace would normally include a plurality of burners and, in the case of a petroleum cracker, ten or more burners could be  
25 provided. Thus if necessary, the camera could be programmed to move along a row of burners and to take several pictures of respective burners or groups thereof.

30 From a further aspect, the present invention provides an apparatus comprising a furnace, a burner for burning natural gas in the furnace and an apparatus for viewing the flame produced by the burner, the apparatus for viewing the flame comprising an interference filter adapted to pass light of the wavelength of sodium only.

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In one preferred embodiment, the apparatus further comprises a window provided in the wall of the furnace through which the burner can be viewed.

Preferably, the window is made of quartz.

5 In one preferred embodiment, the interference filter could be provided as a panel attached to the sealed window of the furnace.

10 Still more preferably, the filter is a panel which can be placed over the window or removed by a user as required. Thus for example, the filter could be hinged to the wall of the furnace to allow quick and easy adjustment thereof.

15 The provision of a panel over the window is considered to be novel and inventive in its own right and so, from a further aspect, the present invention provides a furnace comprising a burner housed within the walls thereof and a window provided in a wall of the furnace, wherein an interference filter adapted to pass light of only a narrow wavelength range is provided in  
20 or on the window.

In an alternative embodiment, the apparatus comprises a pair of glasses or goggles comprising an interference filter in each lens thereof.

25 The provision of such goggles is also considered to be novel and inventive in its own right and so, from a further aspect, the present invention provides glasses comprising an interference filter provided in each lens thereof, wherein the interference filter is adapted to pass light of the wavelength of sodium only.

30 In another alternative embodiment of the invention, the apparatus comprises a camera in which the

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Claims

1. A method of viewing the flame produced by a burner in a furnace, wherein the fuel burnt by the burner is natural gas, comprising viewing the flame through an interference filter adapted to pass light of the wavelength of sodium only.
2. A method as claimed in claim 1, wherein the furnace is the pyrolysis section of a petroleum cracker.
3. A method as claimed in claim 1 or 2, wherein the fuel burnt by the burner is a mixture of hydrogen, methane and air.
4. A method as claimed in claim 1, 2 or 3, wherein a window is provided in the wall of the furnace through which the burner flame can be viewed.
5. A method as claimed in claim 4, wherein the window is made of quartz.
6. A method as claimed in claim 4 or 5, wherein the interference filter is provided as a panel attached to the window of the furnace.
7. A method as claimed in claim 6, wherein the panel is hinged to the furnace so it can be placed over the window or removed by a user as required.
8. A method as claimed in any preceding claim, wherein a pair of glasses or goggles having an interference filter in each lens thereof is provided.
9. A method as claimed in any preceding claim, wherein the interference filter is provided in a camera arranged inside the furnace and adapted to photograph the burner

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at regular intervals.

10. A method as claimed in claim 9, wherein the  
information from the camera is relayed to an operator  
5 who makes any necessary adjustments to the burner from a  
remote location.

11. A method as claimed in claim 9 or 10, wherein the  
camera is programmed to photograph the burner about once  
10 every 10 minutes.

12. A method as claimed in any of claims 9 to 11,  
wherein the camera is programmed to move along a row of  
burners and to photograph groups of one or more burner  
15 flames in turn.

13. An apparatus comprising a furnace, a burner for  
burning natural gas in the furnace and an apparatus for  
viewing the flame produced by the burner, the apparatus  
20 for viewing the flame comprising an interference filter  
adapted to pass light of the wavelength of sodium only.

14. An apparatus as claimed in claim 13, wherein a  
window is provided in the wall of the furnace through  
25 which the burner flame can be viewed.

15. An apparatus as claimed in claim 14, wherein the  
window is made of quartz.

16. An apparatus as claimed in claim 14 or 15, wherein  
the interference filter is provided as a panel attached  
30 to the window of the furnace.

17. An apparatus as claimed in claim 14, 15 or 16,  
wherein the filter is a panel which can be placed over  
35 the window or removed by a user as required.



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18. An apparatus as claimed in any of claims 13 to 17, wherein the apparatus for viewing the flame comprises a pair of glasses or goggles comprising an interference filter in each lens thereof.

5

19. An apparatus as claimed in any of claims 13 to 18, wherein the apparatus for viewing the flame comprises a camera in which an interference filter is provided, wherein the camera is arranged inside the furnace and adapted to photograph the burner flame at regular intervals.

10

20. An apparatus as claimed in claim 19, comprising means for relaying the information from the camera to an operator and means for making any necessary adjustments to the burner from a remote location.

15

21. An apparatus as claimed in claim 19 or 20, wherein the camera is programmed to photograph the burner about once every 10 minutes.

20

22. An apparatus as claimed in any of claims 19 to 21, wherein the camera is programmed to move along a row of burners and to photograph groups of one or more burner flames in turn.

25

23. A furnace comprising a burner for burning natural gas housed within the walls thereof and a window provided in a wall of the furnace, wherein an interference filter adapted to pass light of the wavelength of sodium only is provided in or on the window.

30

24. Glasses comprising an interference filter provided in each lens thereof, wherein the interference filter is adapted to pass light of the wavelength of sodium only.

35